MILL PROCESS DESCRIPTION

1.0 Mill Process Description

The Haile Gold Mine process facility incorporates both physical and chemical separation process techniques to liberate and concentrate the gold from the ore. The primary unit operations include:

- Crushing and Coarse Ore Storage
- Crushed Ore Reclaim
- Grinding
- Flotation
- Concentrate Treatment
- Flotation Tailing Treatment
- Tailing Systems
- Carbon Handling and Refinery

In addition, ancillary operations include:

- Reagent Storage and Mixing
- Water Systems
- Compressed Air Systems
- Process Containment and Events Pond

The following sections describe the processes and circuits involved. They are schematically shown on the Simplified Mill Process Flowsheet Figure 1-1 and Mill Site Plan Figure 1-2.

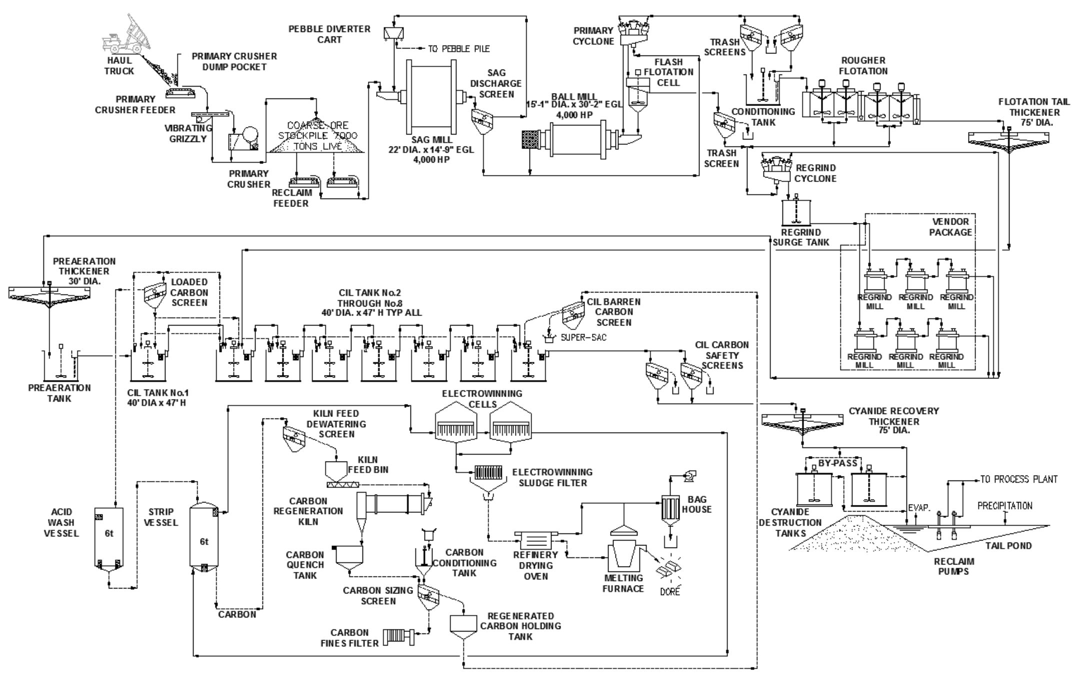

Figure 1-1 Simplified Mill Process Flowsheet

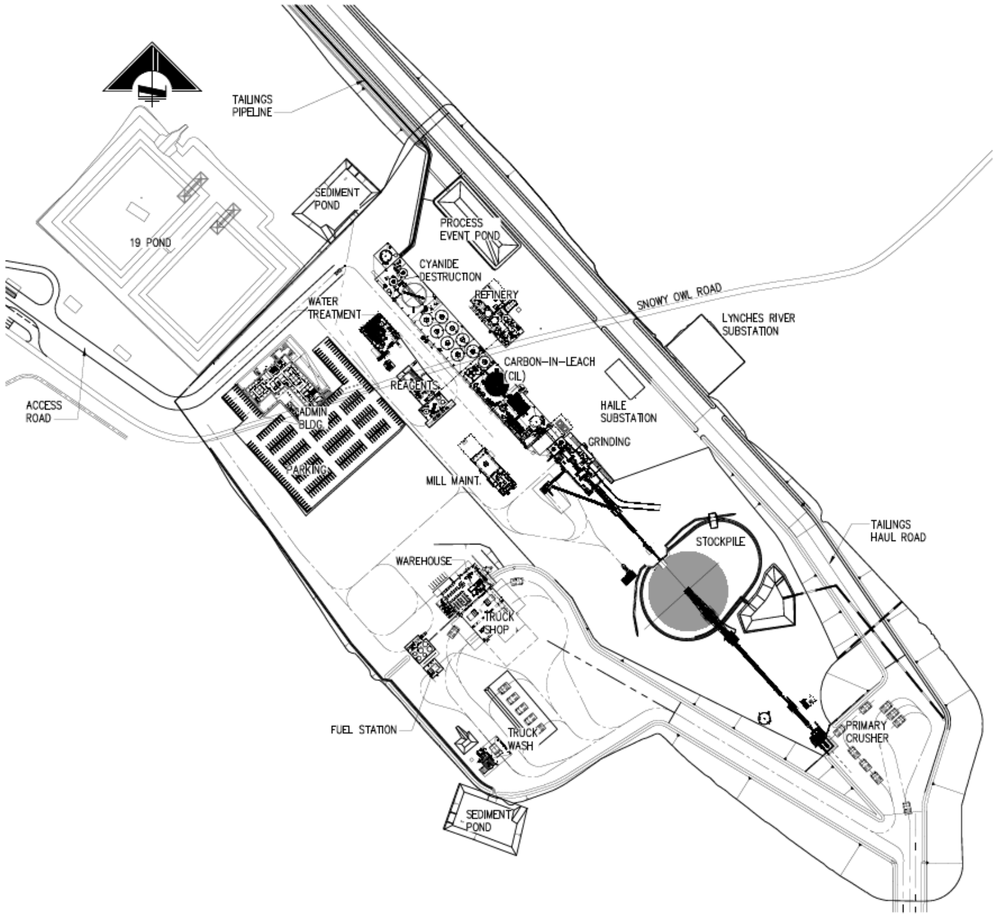

Figure 1-2 Mill Site Plan

1.1. Crushing and Coarse Ore Storage

Ore from the mine will be transported to the primary crusher in haul trucks and dumped into a dump pocket that feeds the primary crusher. The ore is crushed to less than six (6) inches in the primary crusher. The trucks dump ore into a feed hopper or to a stockpile ahead of the primary crusher. A front end loader will be used to feed the crusher feed hopper, as required.

The ore will discharge from the dump pocket using an apron feeder. Material is loaded onto a vibrating grizzly that is slotted to separate large ore particles from small ore particles. Ore particles that are smaller than six inches will pass through the vibrating grizzly and discharge onto the crusher discharge conveyor. Ore particles that are larger than six inches are fed to the jaw crusher, crushed, and then re-combined with the ore on the discharge conveyor.

A hydraulically operated rock breaker is available for breaking oversize rock delivered to the jaw crusher, as required. The primary crushing facility will be equipped with an air compressor to provide high pressure air requirements for maintenance equipment such as air tools and air lances.

The primary crusher discharge conveyor will feed crushed ore to the coarse ore stockpile feed conveyor. The coarse ore stockpile feed conveyor will transport the ore to a conical coarse ore stockpile. The crushing production rate will be monitored by a belt scale mounted on the coarse ore stockpile feed conveyor. A metal detector will be installed over the primary crusher discharge conveyor to detect any tramp metal on the conveyor.

A water spray system will be installed to suppress dust in the dump pocket; over the primary crusher vibrating grizzly; transfer points between conveyors; and stockpile feed conveyor discharge chute.

The coarse ore stockpile will have approximately one day of full throughput live storage capacity. Dead storage may be recovered by bulldozer or other mobile equipment, as required.

Any ore spillage will be returned to the nearest belt conveyor for processing. A concrete containment area with slab on grade and cast-in-place wall will contain precipitation and process spills from the crushing system. A sump pump will be used to transfer contained material to the coarse ore stockpile collection pond.

1.2. Crushed Ore Reclaim

Two draw points under the crushed ore stockpile will provide ore to two reclaim apron feeders located in a tunnel under the stockpile. The reclaim feeders will discharge onto the SAG mill feed conveyor. Each feeder will be capable of feeding up to 500 tons per hour of ore to the SAG mill feed conveyor. The feeders will be variable speed and controlled to maintain the ore feed rate to the grinding circuit. Either or both feeders may be operated at any time. The speed of the feeders will be controlled by a control signal that will be provided by a belt scale mounted on the conveyor downstream of the feeders.

Precipitation that lands on the ore stockpile or that is collected in the reclaim tunnel area will be collected in the lined coarse ore stockpile collection pond and pumped to the process plant for use in the process or to 19 pond feeding the water treatment facility.

1.3. Grinding

Crushed ore from the reclaim tunnel is conveyed to the grinding circuit. The grinding circuit will process an average of 7,000 tons of ore per day on a 365 days per year basis. At 92% plant availability, this equates to a design throughput of 7,609 ton per day. Ore will be ground to a final product size of 80% passing 200 mesh (74 microns) in a semi-autogenous (SAG) primary mill and secondary ball mill grinding circuit.

Primary grinding will be performed in a SAG mill. Ore from the SAG mill feed conveyor is fed into the SAG mill and mixed with water to make a solid and liquid mixture referred to as slurry. The SAG mill will operate in closed circuit with a SAG mill discharge screen. Closed circuit means that the slurry discharge from the mill is screened with the coarse material that does not pass the screen openings returning to the feed of the SAG mill and the finer material progressing to the second stage of grinding in the ball mill circuit.

SAG mill discharge screen oversize material will report to a series of two belt conveyors that will transport the oversize back to the SAG mill feed conveyor.

Secondary grinding will be performed in a ball mill and operating in a closed circuit with hydrocyclones. The ball mill discharge slurry will fall through the trommel where it will be combined with SAG mill discharge screen undersize slurry in the hydrocyclone feed pump box. This combined slurry will be pumped, using variable speed slurry pumps, to the hydrocyclones for sizing. Hydrocyclone underflow will flow by gravity back to the ball mill for additional grinding.

The trommel screen will separate ball chips and tramp material from the process stream and deliver that material to tote bin for removal.

A portion of the combined SAG mill and ball mill slurry will be pumped to a flash flotation cell. The flash flotation cell separates the gold bearing sulfide minerals from the gangue material into a concentrate stream containing the gold containing sulfides and a tail stream containing the gangue. The flash flotation concentrate will flow by gravity to the regrind circuit while the tail is returned to the hydrocyclone feed sump.

Hydrocyclone overflow (final grinding circuit product) will flow by gravity to a vibrating trash screen for removal of tramp material. Trash screen oversize will discharge into a tote bin for removal. Trash screen undersize will flow by gravity to the rougher flotation conditioning tank.

An overhead crane will be provided for maintenance purposes. The area will be equipped with a sump and pump for clean-up purposes.

The grinding and flotation circuit is an open air plant covered with a roof only. The floor will be concrete with containment walls to contain process upsets within the grinding and flotation area. The floor will be sloped to floor sumps that collect the contained solution and solids, which are then pumped back to the hydrocyclone feed pump box. Section 1.12 discusses containment.

1.4. Flotation

As discussed previously, the hydrocyclone overflow flows to a trash screen and then to a conditioning tank. Flotation reagents are added here and vigorously mixed. The slurry overflows to four sequential rougher flotation cells. The pyrite concentrate reports to the regrind circuit and the tailing reports to the flotation tails thickener. The flotation tailing has enough value to leach and is pumped to CIL from the thickener underflow.

The combined SAG mill and ball mill discharge will be pumped to a flash flotation cell. Tail from the flash flotation cell will flow by gravity back to the hydrocyclone feed sump. Concentrate from the flash flotation cell will flow by gravity to flash flotation screen for removal of tramp. Trash screen undersize will flow by gravity to the regrind cyclone feed pump box.

Flotation concentrate from both the flash flotation cell and the rougher flotation cells will be pumped to a regrind circuit.

Various flotation reagents will be added to the SAG mill feed, to the cyclone feed sump, to the rougher flotation conditioning tank and stage added to the rougher flotation cells as needed to achieve efficient flotation recovery. Section 1.9 discusses these reagents in more detail along with associated addition points.

1.5. Concentrate Treatment

1.5.1. Regrind

Combined flotation concentrate from the flash flotation cell and the rougher flotation cells will be pumped using a variable speed pump to the regrind hydrocyclone cluster. The underflow stream from the regrind hydrocyclone cluster will flow by gravity to the regrind mill circuit for additional grinding. The target P80 is 13 µm. Regrind hydrocyclone underflow will be bypassed to an agitated surge tank ahead of the regrind mill for storage when the regrind mill is down for maintenance.

Overflow from the regrind hydrocyclone cluster will flow by gravity to the regrind mill discharge pump box. Product from the regrind mill will be combined with the regrind cyclone overflow in the regrind mill discharge pump box, where it will be pumped using a variable speed pump to the pre-aeration thickener feed box.

1.5.2. Pre-aeration

Reground concentrate will be pumped to a thickener. Flocculant and dilution water will be added to the thickener feed to aid in settling. In addition, milk of lime (MOL) may be added to the thickener feed.

The withdrawal rate of thickened solids will be controlled by a variable speed thickener underflow pump to maintain the proper slurry characteristics. Underflow from the pre-aeration thickener will be pumped at approximately 60% solids to an agitated pre-aeration tank where it will be diluted to approximately 45% solids with reclaim water ahead of a series of eight agitated carbon-in-leach (CIL) tanks.

The thickener overflow will be pumped using a fixed speed pump to the internal reclaim water tank for reuse in the grinding and flotation process circuits.

The pre-aeration circuit will consist of one agitated tank. Process air will be piped to the tank and bubbled through the slurry to oxidize the ore. Aeration enhances gold recovery and reduces the amount of reagents required for leaching. Lead nitrate will be added to promote better gold recovery and milk of lime is added, as required, to maintain proper pH.

Slurry from the pre-aeration tank will be pumped to CIL tank #1 where it will be leached with cyanide in the presence of activated carbon.

The pre-aeration thickener will be mounted on a floor foundation. A concrete containment area with slab on grade and cast-in-place walls will contain precipitation and process spills within the regrind, pre-aeration and thickening areas. A sump pump will transfer the contained material back to the pre-aeration thickener for processing. Section 1.12 discusses containment.

1.6. Flotation Tailing Treatment

The rougher flotation tailing will contain enough gold to justify further processing. This section describes the process that will be used to recover the additional gold from the flotation tailing.

1.6.1. Flotation Tail Thickener

The rougher flotation tailings will be pumped to a thickener. Flocculant, milk of lime and dilution water (internal reclaim) will be added to the thickener feed to aid in settling.

The withdrawal rate of settled solids from the thickener will be controlled by a variable speed thickener underflow pump to maintain the proper slurry characteristics. Underflow from the flotation tailing thickener will be pumped using a variable speed slurry pump, at approximately 60% solids, to the CIL tank #2 feed box where it is combined with the discharge from CIL tank #1. The combined slurry will be diluted to approximately 45% solids with reclaim water ahead of the remaining seven CIL tanks where it will be leached with cyanide in the presence of activated carbon.

The thickener overflow will be pumped using a fixed speed pump to the internal reclaim water tank.

The flotation tail thickener will be mounted on a floor foundation. A concrete containment area with slab on grade and cast-in-place walls will contain precipitation and process spills. A sump pump will transfer the contained water back to the flotation tail thickener. Section 1.12 discusses containment.

1.6.2. Carbon-In Leach (CIL)

The CIL circuit will consist of eight agitated tanks. The gold is leached from the ore and adsorbed onto activated carbon that is mixed within the slurry. The first CIL tank will be used to leach reground flotation concentrate only and will provide approximately 24 hours of retention time. The remaining seven CIL tanks (i.e. tanks #2 through #8) will be used to leach the combined flotation tailing and discharge from tank #1. The seven tanks will provide approximately 21 hours of total retention time at 45% solids. Cyanide solution may be added to the first and second CIL tanks. Process air will be piped to all tanks. Milk of lime will be added to the CIL circuit to adjust pH, if required.

Slurry will advance by gravity from tank to tank, exiting the last tank and reporting by gravity to the CIL carbon safety screen.

The CIL tanks will nominally contain 10 to 20 g/L of 6x12 mesh granular activated carbon to adsorb the dissolved precious metals from the slurry.

Carbon, which has a larger particle size than the ground slurry, will be retained in each CIL tank by an inter-stage screen that will allow only the ore slurry to flow from tank to tank. The carbon will be advanced to the next tank in series (counter-current to the slurry flow) on a batch basis using vertical recessed impeller pumps located in each tank. Loaded carbon (i.e. carbon with precious metals adsorbed onto it) from either the first tank, the second tank, or the third tank will be pumped to the loaded carbon screen. The carbon (screen oversize) will be water washed on the screen and then discharged by gravity into the acid wash vessel while the screen undersize will be returned to the appropriate CIL tank.

A concrete containment slab on grade and containment walls will contain precipitation and process spills in the CIL area. A sump pump will transfer the material back to the process. Section 1.12 discusses containment.

1.6.3. CIL Carbon Safety Screen

Slurry discharging from the last CIL tank will flow by gravity to a CIL carbon safety screen fitted with 28-mesh screen panels. The purpose of this screen is to prevent accidental losses of activated carbon.

The oversize (carbon) from the safety screen will be collected and returned to the CIL circuit. Slurry that passes through the screen will be pumped using a fixed speed pump to the cyanide recovery thickener.

A concrete containment slab on grade and containment walls will contain precipitation and process spills. A sump pump will transfer this material back to the process. Section 1.12 discusses containment.

1.7. Tailing Systems

1.7.1. Cyanide Recovery Thickener and Tailing Destruction

The CIL carbon safety screen undersize stream will report to the cyanide recovery thickener feed box. Dilution water, flocculant, and milk of lime are added to the slurry, which is then thickened to approximately 55% solids. Overflow solution containing cyanide from the cyanide recovery thickener is routed to the reclaim water tank for reuse in the process. Within process operating limits, a maximum amount of dilution water will be used at all times to minimize the cyanide remaining in the slurry. Under normal operating conditions, the cyanide recovery thickener underflow will be pumped to the tailing storage facility. The withdrawal rate of settled solids will be controlled by a variable speed thickener underflow pump to maintain proper slurry characteristics.

As stated above, cyanide recovery thickener underflow will be pumped to the tailing storage facility under normal conditions. If the cyanide level is high enough (i.e. greater than or equal to 50 ppm weak acid dissociable (WAD) cyanide), the flow can be directed to the cyanide destruction tanks, where cyanide is destroyed using the SO2/Air process.

In the cyanide destruction tanks, residual WAD cyanide will be oxidized to the relatively non-toxic form of cyanate by the SO2/Air process using ammonium bisulfite and oxygen, with copper sulfate as a catalyst as needed. Milk of lime will also be added as needed to maintain a slurry pH in the range of 8.0 to 8.5. The more stable iron cyanides are removed from solution as an insoluble ferrocyanide precipitate. The cyanide levels are thereby reduced to an environmentally acceptable level.

Cyanide destruction is accomplished in two agitated tanks operating in parallel. Each tank will provide a residence time of approximately 30 minutes.

Discharge from the cyanide destruction tanks will be final plant tailing and pumped to the tailing storage facility.

A concrete containment slab on grade and containment walls will contain precipitation and process upsets in the cyanide recovery thickener and cyanide destruction area. A sump pump will transfer the material back to the cyanide recovery thickener. Section 1.12 discusses containment.

1.8. Carbon Handling and Refinery

1.8.1. Carbon Acid Wash

Loaded carbon from the CIL circuit will flow by gravity to a carbon acid wash vessel. The carbon will be acid washed to remove inorganic contaminants (mainly calcium carbonate) by circulating dilute hydrochloric acid from the acid wash recirculation tank upwards through the bed of carbon. Residual acid in the acid wash vessel will be neutralized before transferring the carbon to the strip vessel. The carbon is transferred with water using a horizontal recessed impeller pump. Carbon transfer water comes from the closed circuit carbon transfer water system.

A concrete containment slab independent of the carbon strip area containment slab on grade and containment walls will contain precipitation and process spills in the acid wash area. A sump pump will transfer the material back to the process. Section 1.12 discusses containment.

1.8.2. Carbon Stripping

Gold will be removed from the carbon utilizing a pressure Zadra circuit. The pressure Zadra circuit comprises circulating a 280ºF caustic cyanide solution upward through the partially fluidized bed of loaded carbon. This process is also known as carbon stripping. A more thorough description of the process is as follows:

The loaded carbon from the acid wash circuit will be pumped into the top of the strip vessel and the excess water will be drained to the floor sump and returned to the process using a sump pump. After the complete batch of carbon has been transferred, the strip cycle will be initiated by pumping hot caustic cyanide solution from the barren solution tank into the bottom of the strip vessel. The solution will discharge through a screened outlet at the top of the vessel before passing through the heat recovery exchanger to the pregnant (strip solution that contains the concentrated gold) solution tank. The hot side of the final heat exchanger is piped to a thermal fluid heater. Approximately 10 Bed Volumes (BV's) at a rate of 3 BV/hr will be passed through the carbon to remove all the precious metals. A Bed Volume is the volume of solution that occupies the space in the vessel that is occupied by the carbon. A final 3 BV of water will be used to wash the carbon at the end of the stripping cycle. After the stripping circuit has been cooled down, the carbon will be transferred with water to the reactivation circuit using a horizontal recessed impeller pump.

A concrete containment slab on grade and containment walls, independent of the acid wash area, will contain precipitation and process spills in the carbon strip area. A sump pump will transfer the water back to the process. Section 1.12 discusses containment.

1.8.3. Refinery

The pregnant strip solution produced in the carbon strip circuit is collected in the pregnant solution tank, where it is pumped to electrowinning cells to recover the precious metals. Electrowinning is used to recover the precious metals from the pregnant solution, and it is an electrolytic process where the precious metals are recovered from the solution by passing direct electrical current between electrodes (anodes and cathodes) immersed in the solution. As the current passes from the anode to the cathode, the precious metals loosely plate onto the cathode as a sludge.

Electrowinning is accomplished in three electrowinning cells in parallel. Each cell contains anodes (304-stainles-stell punched plate) and cathodes (stainless steel mesh held in place by 304-steel bayonets and wire frames, and suspended in cross linked polyethylene baskets). Each cell has a DC rectifier capable of delivering a current of 0 to 2000 amps at a voltage of 0 to 9 volts.

The flow rate of pregnant solution through each cell is approximately 50-70 gallons per minute (gpm). During electrowinning the solution flows by gravity to the electrowinning (EW) pump box. From there, the EW barren solution pump delivers the solution to the barren strip solution tank. The sludge will be periodically washed off the cathodes and recovered as a damp cake in a plate and frame filter press. The filter cake will be dried in a drying oven prior to smelting.

The dried filter cake (gold sludge) will be processed, along with pre-mixed flux, in an electric induction melting furnace. When the sludge and flux mixture becomes fully molten, the components separate into two distinct layers: slag (on the top) and metal (on the bottom). The slag layer, containing most of the impurities, is poured off first into a conical slag pot. The remaining molten metal, containing the precious metals and minor impurities, is then poured off into bar molds.

After cooling and solidifying, the metal bar (doré) will be dumped from the mold and slag will be knocked off by hand. The resulting doré bar will be further cleaned of residual slag using a shot cleaning machine and finished as required with a needle gun. The cleaned bars are then weighed and stamped with an I.D. number and weight. Doré bars, each weighing a total of approximately 50 to 80 pounds, will be the final product of the operation and will be stored in a vault awaiting shipment.

Slag will be collected and returned to the process.

Exhaust from the barren solution tank, pregnant solution tank, drying oven, and electrowinning cells will be collected through ductwork and passed through an exhaust control system before discharging to atmosphere. Fumes from the induction melting furnace will be collected through ductwork and cleaned in a bag house before discharging through an exhaust control system to atmosphere.

The refining building will be an enclosed steel building with steel framed roof and metal roofing. Water used for cleanup and any spills will be collected and pumped back into the process. Section 1.12 discusses containment.

1.8.4. Carbon Regeneration

Following stripping, the carbon will be thermally regenerated before being returned to the CIL circuit. Carbon used in the CIL circuit can be fouled by various organic compounds such as flocculant and flotation reagents. The organics on the surface and in the pores of the carbon blind the adsorption sites available for gold/silver recovery. Thus, organics are removed from the carbon by volatilizing them at high temperatures. The process of restoring the active sites on the surface of the carbon and removing the organics is called carbon regeneration.

Stripped carbon will be pumped from the bottom of the strip vessel to a dewatering screen ahead of a rotary tube regeneration kiln. The coarse carbon particles in the screen oversize will go into the reactivation kiln feed bin. The fine carbon particles and the transfer solution will pass through the screen and flow to a carbon fines settling tank. The feed bin has wedge wire screens sitting in discharge pipes in the bottom of the bin to permit any remaining solution may be drain to the floor sump where it is pumped to CIL.

Well drained damp carbon will be fed from the feed bin into the feed end of the rotary tube regeneration kiln using a variable speed screw conveyor. The regeneration kiln will be heated to temperatures as high as 1400 ºF. After entering the feed end of the tube, the carbon will travel down the sloping tube and discharge into a quench tank. As the hot carbon contacts the fresh water in the quench tank, the carbon is cooled, and steam is generated. Steam will provide the desired moisture in the atmosphere above the carbon inside the kiln tube and helps to keep the carbon from oxidizing.

Exhaust gases from the reactivation kiln will pass through a wet scrubber and exhaust control system which discharges to atmosphere.

Quenched carbon will be pumped by the quench tank carbon transfer pump to a carbon sizing screen. The coarse carbon particles in the screen oversize will go into the regenerated carbon holding tank. The fine carbon particles and the bulk of the fresh water will pass through the screen and flow to the carbon fines settling tank. Regenerated carbon will be pumped, using carbon transport water, from the regenerated carbon holding tank back to CIL tank #8 for reuse.

Periodically, new activated carbon must be added to the system to make up for fine carbon losses. A bulk bag containing approximately 1500 lb of carbon will be suspended above the carbon quench tank. The tank is filled with water, which will be mixed by an agitator. The bottom of the bag will be opened and carbon allowed to flow into the tank. The agitating action quickly wets the surfaces of the carbon and attritions the carbon particles to break up any lumps.

Screen underflow containing carbon fines from the kiln feed dewatering screen and the carbon sizing screen will flow to the carbon fines settling tank. Carbon fines will be recovered using a plate and frame filter and sold or disposed of.

A concrete containment slab on grade and containment walls will contain precipitation and process spills. The regeneration area sump pump will return the solutions and spills to the process. Section 1.12 discusses containment.

1.9. Reagent Storage and Mixing

Reagents requiring handling, mixing, and distribution systems include:

- Sodium cyanide (NaCN)
- Quicklime (Pebble Lime) (CaO)
- Aero 404
- Potassium Amyl Xanthate (PAX)
- Caustic (sodium hydroxide) (NaOH)
- Ammonium Bisulfite (ABS)
- Copper Sulfate ($CuSO_4$)
- Hydrochloric Acid (HCl)
- Sulfuric Acid (H_2SO_4)
- Lead Nitrate ($PbNO_3$)
- Flocculant
- Antiscalant
- UNR 811A

More detailed descriptions of the reagents are given in later sub-sections.

The dry reagents will be stored under cover, then mixed in reagent tanks and transferred to distribution tanks for process use.

The reagent building will be a steel framed structure with metal roofing. In general, the building is open, but metal siding will be installed where necessary to keep reagents dry. The floors will be slab on grade concrete with concrete containment walls to capture spills and any precipitation that enters the sides of the structure. Section 1.12 discusses containment.

Reagents which are not compatible to be stored together will be kept in separate containment areas within the reagent storage area. Sump pumps in the different containment areas will return these materials to the appropriate process stream.

1.9.1. Sodium Cyanide (NaCN)

Sodium cyanide solution will be added to the ore in the leach circuit to recover gold and silver. Also, sodium cyanide solution will be used to promote the removal of gold and silver from the carbon in the carbon stripping circuit.

Dry sodium cyanide will be delivered in bulk quantity by 20 ton trucks.

Sodium cyanide solution will be prepared by adding water to a sodium cyanide mix tank and circulating the solution between the mix tank and the bulk truck until all the dry sodium cyanide has been dissolved. The tanker truck will then be emptied and thoroughly rinsed before leaving site. Throughout the mixing process, the bulk tanker is parked on containment that drains to the main sodium cyanide area sump. Sodium cyanide solution will be distributed to the CIL circuit and barren strip solution tank using individual metering pumps.

1.9.2. Quicklime (Pebble Lime) (CaO)

Milk of lime slurry will be produced by hydrating pebble quick lime in a lime slaker. Milk of lime slurry will be used to control pH in various parts of the process. Milk of lime slurry will be distributed to the CIL circuit, cyanide destruction tanks and thickeners using timer controlled on-off valves in a circulating loop.

Dry pebble quicklime will be delivered to the site in bulk quantity by 20 ton trucks and will be pneumatically loaded to a cone bottom lime silo storage bin. The bin will be equipped with a bin vent type dust collector.

1.9.3. AERO 404

AERO 404 promoter will be added to the SAG mill and rougher flotation circuit to enhance flotation of gold and gold-bearing sulfide minerals.

AERO 404 will be delivered as an aqueous solution in bulk tanker trucks. AERO 404 may be added directly or may be diluted for ease of metering. AERO 404 will be added to the SAG mill prior to flash flotation and to the rougher flotation conditioning tank using individual metering pumps.

1.9.4. Potassium Amyl Xanthate (PAX)

PAX (collector) will be added to the SAG mill and rougher flotation circuit to enhance the flotation of gold and gold-bearing sulfide minerals.

Dry PAX will be delivered to the site in supersacs. The PAX mix system will include agitated mix tank and a sloped bottom distribution tank.

PAX will be added to the SAG mill prior to flash flotation and to the rougher flotation conditioning tank using individual metering pumps.

1.9.5. Caustic (NaOH)

Caustic soda solution will be used in the carbon strip circuit to neutralize acidic solutions after acid washing the carbon and as a reagent in the carbon stripping process. Caustic can be added, if needed, to the sodium cyanide mixing system to maintain the proper pH of the cyanide solution.

Liquid caustic soda (50% solution) will be delivered in bulk tanker trucks. Caustic will be off loaded to a heated and insulated storage tank. Caustic will be distributed to the appropriate location on an as-needed basis using individual metering pumps.

1.9.6. Ammonium Bisulfite

Ammonium bisulfite will be added to the cyanide destruction circuit as the primary source of sulfur dioxide (SO_2) to oxidize weak acid dissociable (WAD) metal cyanide complexes.

Liquid ammonium bisulfite will be delivered in 20 ton bulk tanker trucks and offloaded into a storage tank. The ammonium bisulfite solution will be pumped directly from the storage tank to the cyanide destruction tanks using a metering pump.

1.9.7. Copper Sulfate

Copper sulfate will be added to the cyanide destruction tanks to provide copper ions as a catalyst for the destruction reaction.

Dry copper sulfate will be delivered in supersacs and stored in a dry area. The copper sulfate system will comprise an agitated mixing tank and a holding tank.

1.9.8. Hydrochloric Acid

Hydrochloric acid will be used in the carbon strip circuit to acid wash carbon.

Hydrochloric acid (30%) will be delivered in 20 ton bulk tanker trucks. Acid will be off loaded from the bulk truck to a storage tank. A dilute acid solution will be prepared by pumping acid directly from the storage tank to the acid wash circulating tank as needed.

1.9.9. Sulfuric Acid

Sulfuric acid may be used in the grinding and rougher flotation circuits to maintain pH.

Sulfuric acid (93%) will be delivered in 20 ton bulk tanker trucks. Acid will be off loaded from the bulk truck to a storage tank. Metering pumps will be used to deliver sulfuric acid to the SAG mill and to the rougher flotation conditioning tank.

1.9.10. Lead Nitrate

Lead nitrate will be added to the pre-aeration tank to enhance leaching. Dry lead nitrate will be delivered in 25 kg pails and stored in a dry area. The lead nitrate system will comprise an agitated mixing tank and a holding tank. A metering pump will be used to deliver lead nitrate solution to the pre-aeration tank feed box.

1.9.11. Flocculant

Flocculant will be added to the pre-aeration thickener, to the flotation tailing thickener and to the cyanide recovery thickener to enhance solids settling.

Pre-engineered flocculant mixing systems will be used to mix and distribute dry flocculant. The dry flocculant will be delivered in supersacs.

1.9.12. Antiscalant

Antiscalant will be added to the reclaim water and internal reclaim water tanks to prevent scaling in pipelines, tanks, etc. The antiscalant will be delivered in bulk tanker trucks and will be added to the process using metering pumps directly coupled to vendor supplied tanks,

1.9.13. UNR 811A

If needed, UNR 811A will be added, as required, to the reclaim water tank and the internal reclaim water tank using metering pumps directly coupled to vendor supplied tanks. UNR 811A is used to abate mercury production by complexing mercury to form a stable organic sulfide precipitate.

1.9.14. Flux

Flux will be added during the smelting stage to remove contaminants from the electrowinning sludge.

Dry pre-mixed flux will be delivered in 10 lb pre-packaged bags that come in drums on pallets. Flux will be manually added to the melting furnace.

1.10. Water Systems

Water for the Haile Project will be supplied from a variety of sources over the life of the mine (LOM).

Fresh water will be supplied from pit depressurization wells. Water from the wells will be pumped to a fresh water tank. The fresh water tank will supply the requirements for reagents, crushing area dust suppression, and for use as makeup water in ore processing. In addition, fresh water will be available at the truck shop and the truck wash.

Potable water will be supplied from the city and/or county municipal service to the administration, truck shop/warehouse, mill maintenance and mill operations buildings. The fire water system will be supplied from the municipal service too.

Internal reclaim water will be recovered from the pre-aeration thickener and flotation tail thickener for reuse in the process. The recovered water from the ‘non-cyanide’ unit operations of the process (i.e.: flotation tail thickener overflow and pre-aeration thickener overflow) will be directed to an Internal Reclaim water tank. Make-up water from the fresh and/or reclaim water tanks will be added to the internal reclaim water tank as required.

Recovered water, process water that is reclaimed from the system after cyanide addition in the leach circuit, is recovered from the cyanide recovery thickener and tailing storage facility (TSF).

Process water will be reclaimed from the tail pond using reclaim water pumps mounted on floats. Reclaimed water will be pumped to the reclaim water tank, located near the process plant, for subsequent use as make-up water in CIL, tailing handling, and carbon handling areas. This is shown in the block diagram Figure 1-3.

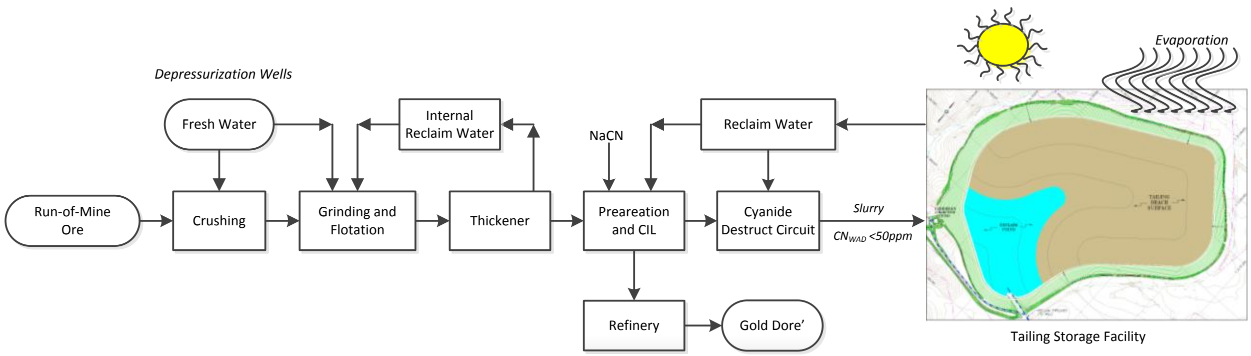

Figure 1-3 Water System Block Diagram

Water which comes into contact with potentially acid generating (PAG) material is classified as contact water. Contact water from surrounding locations such as Johnny's PAG, coarse ore stockpile, and mining pits is collected in a series of lined ponds and pumped to 19 Pond.

The 19 Pond is a lined pond located near the processing facility which provides 19 million gallons worth of storage volume. Contact water is pumped to either the mill or, if the water is not needed, to the wastewater treatment facility. The wastewater treatment facility will treat contact water to produce an effluent quality that meets permit discharge levels. Treated water is pumped to the NPDES discharge point.

1.11. Compressed Air Systems

An air compressor and air receiver will be installed for operation and maintenance at the primary crushing area.

Plant air compressors will provide service and instrument air for grinding through cyanide destruction unit operations. An air dryer will remove moisture in instrument air. Plant air and instrument air receivers will be provided.

Individual low pressure blowers will be located in the flotation area to provide air to the flash flotation cell and to the rougher flotation cells.

A low pressure blower will provide air to the bottom of the pre-aeration tank and to the CIL tanks.

A low pressure blower will provide air to the cyanide destruction tanks.

Tank mounted reciprocating air compressors will be installed for operation and maintenance at the truck shop and at the mill maintenance building.

1.12. Process Containment and Events Pond

To ensure all process upset conditions do not impact the environment, the process facility has been designed with the following safe guards:

1.12.1. Process Containment

The process facilities will be designed to contain any spills caused by an upset in process. Each area, as described previously in this document, will be designed such that it is built on a concrete floor that has cast in place concrete walls. The floor area and wall heights will be designed to capture any process spills and the floors will be sloped toward a collection sump for cleanup and the return of process solutions or slurries back to the process streams for which it is best suited. Table 1-1 summarizes the main containment areas.

TABLE 1-1 Process Containment Philosophy

Containment Area	**Indoor / Outdoor**	**Containment System**	**Containment Volume**	**Sump Pumps to**
Primary Crusher	Outdoor	Concrete Pad with stem walls	100 year/ 24 hour storm event	Coarse Ore Stockpile Collection Pond
Grinding Building	Covered	Concrete Pad with stem walls	110% of Largest Vessel	Cyclone Feed Pump Box
Flotation and Regrind	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event (utilizing overflow to adjacent containment areas)	Rougher Conditioning Tank
Preaeration Thickener	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event (utilizing overflow to adjacent containment areas)	Preaeration Thickener
Flotation Tail Thickener	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event (utilizing overflow to adjacent containment areas)	Flotation Tail Thickener
Leach (CIL) Area	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event (utilizing overflow to adjacent containment areas)	Leach Tank #2 or Leach Tank #3

Containment Area	Indoor / Outdoor	Containment System	Containment Volume	Sump Pumps to
Cyanide Recovery Thickener/Cyanide Destruction	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event (utilizing overflow to adjacent containment areas)	Cyanide Destruction Splitter Box
Reagent Mixing Area	Covered	Concrete Pad with stem walls	110% of Largest Vessel in each containment area + 100 Year/ 24 hour storm event	Cyanide Destruction Splitter Box
Reagent Storage Area	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel in each containment area + 100 Year/ 24 hour storm event	CIL Tank #1
Reclaim Water Pad	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event	Reclaim Water Tank
Tailing Line	Outdoor	Lined Trench and Pond	110% of the entire pipeline volume + 100 year/ 24 hour storm event	Process Events Pond
Truck Shop Tank Farm	Outdoor	Double Walled Tanks	Containment not required in this area. Tanks are double-walled on concrete foundations.	No sump in this area. Any spills will be immediately contained and remediated at the point of spill
Carbon Acid Wash	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event	Acid Wash Vessel or Carbon Fines Settling Tank
Carbon Strip	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event	Strip Vessel
Carbon Regeneration	Outdoor	Concrete Pad with stem walls	110% of Largest Vessel + 100 Year/ 24 hour storm event	Kiln Feed Dewatering Screen
Refinery	Indoor	Concrete Pad with stem walls	110% of Largest Vessel	Cathode Sludge Tank or EW Barren Solution Return Pump Box
Fueling Station	Outdoor	Double Walled Tanks	Containment not required in this area. Tanks are double-walled on concrete foundations.	No sump in this area. Any spills will be immediately contained and remediated at the point of spill

1.12.2. Events Pond

The Events Pond will be designed to capture any solutions or slurries that escape the main process containment facilities, tailing slurry pipeline or reclaim water line. Each containment area has been designed to capture spills in accordance with Table 1-1. Should multiple events occur, any material that would not fit within the containment area will report to the process events pond. The additional solution or slurry from the failure would exit the containment area through a pipeline and would flow by gravity to the lined pond.

The tailing and reclaim pipelines are designed to have double containment involving either a pipeline within a pipeline or a pipeline within a lined containment structure or trench. Should a failure of the tailing pipeline occur or should an unanticipated power failure occur, the material from the pipeline would drain to the Events Pond for contained collection of the pipeline material.

Once the event materials have been collected and the failures have been repaired, the material that reported to the events pond will be removed and returned to the process area for which it is best suited.